FEDERAL AVIATION AGENCY

Washington 25, D. C.

TECHNICAL STANDARD ORDER

Regulations of the Administrator

Part 514

SUBJECT: **AIRCRAFT WHEELS AND BRAKES** **TSO-C26a**

Technical Standard Orders for Aircraft Materials, Parts, Processes, and Appliances

Part 514 contains minimum performance standards and specifications of materials, parts, processes, and appliances used in aircraft and implements the provisions of sections 3.18, 4a.31, 4b.18, 6.18 and 7.18 of the Civil Air Regulations. The regulation uses the Technical Standard Order system which, in brief, provides for FAA-industry cooperation in the development of performance standards and specifications which are adopted by the Administrator as Technical Standard Orders, and a form of self-regulation by industry in demonstrating compliance with these orders.

Part 514 consists of two subparts. Subpart A contains the general requirements applicable to all Technical Standard Orders. These provisions are summarized below for the convenient reference of the public. Subpart B contains the technical standards and specifications to which a particular product must conform, and each Technical Standard Order is set forth in the appropriate section of Subpart B. The subject Technical Standard Order is printed below. ANY TECHNICAL STANDARD ORDER MAY BE OBTAINED BY SENDING A REQUEST TO FAA, WASHINGTON 25, D. C.

SUBPART A--GENERAL

This subpart provides, in part, that a manufacturer of an aircraft material, part, process, or appliance for which standards are established in Subpart B, prior to its distribution for use on a civil aircraft of the United States, shall furnish a written statement of conformance certifying that the material, part, process, or appliance meets the applicable performance standards established in this part. The statement of conformance must be signed by a person duly authorized by the manufacturer, and furnished to the Chief, Engineering and Manufacturing Division, Bureau of Flight Standards, Federal Aviation Agency, Washington 25, D. C.

Subpart A also requires appropriate marking of materials, parts, processes, and appliances as follows:

(a) Name and address of the manufacturer responsible for compliance,

(b) Equipment name, or type or model designation,

(c) Weight to the nearest pound and fraction thereof,

(d) Serial number and/or date of manufacturer, and

(e) Applicable Technical Standard Order (TSO) number.

In addition, Subpart A provides that no deviation will be granted from the performance standards established in Subpart B, and that the Administrator may take appropriate action in the event of noncompliance with Part 514.

SUBPART B

§ 514.72 Aircraft wheels and brakes - TSO-C26a--(a) Applicability - (1) Minimum performance standards. Minimum performance standards are hereby established for aircraft wheels and brakes which are to be used on United States civil aircraft of the following categories:

Wheels - Transport and non-transport category airplanes.
Wheels - Transport and non-transport category rotorcraft.
Brakes - Transport category airplanes.

New models of wheels and brakes manufactured for installation on the above aircraft on or after June 1, 1961, shall meet the standards of Aeronautical Standard AS 227-C revised February 1, 1959,[1/] with the exceptions in subparagraph (2) of this paragraph.

(2) Exceptions.

(i) Unless determined to be unnecessary, means shall be provided to minimize the probability of wheel and tire explosions which result from elevated brake temperatures.

(ii) Reference paragraph 5.4.7.1 of AS 227-C, Braking Capacity Calculations. The decelerating effects of propeller reverse pitch, drag parachutes and engine thrust reversers shall not be considered in determining brake kinetic energy ratings.

(iii) Taxi and Parking Test. At least one maximum weight landing test followed by a taxi roll, one taxi stop and parking test, which realistically simulate normal airplane operation, shall be conducted on the dynamometer. The taxi speed and distance shall be obtained from the airplane manufacturer.

(iv) Reference Table II of AS 227-C. Change 65 to 100 normal energy dynamometer stops in Method I and II.

(v) Reference Table II of AS 227-C. Change Note 2 to read as follows: One change of brake lining and attached discs is permissible in making the 100 normal energy stops. The remainder of the brake assembly parts shall withstand the 100 normal energy stops without failure or impairment of operation.

(vi) Reference Notes 3, 6, and 8 of Table II of AS 227-C. The most critical speeds used in the analysis shall include consideration for high ambient temperatures and airport elevations.

1/Copies may be obtained from the Society of Automotive Engineers, Inc., 485 Lexington Avenue, New York 17, New York.

(vii) ARP 586 "Wheel Castings" dated March 1, 1960.[1/]

(a) Add the following sentence at the end of paragraph 2. "Acceptance of the provisions contained herein is predicated on the use of a casting factor of not less than 1.33 on ultimate radial and side loads."

(b) Add the words "in accordance with paragraph 4.1 or 4.2" to the end of paragraph 4.3.

(c) Paragraph 5.2.2. Replace the words "When at least five consecutive acceptable quality castings have been produced" by the following: "When quality control history is established, * * * ."

(d) Revise the end of paragraph 9.1 to read as follows " * * * in lieu of the procedures outlined above when authorized by the FAA."

(b) Marking. In lieu of the marking requirements of Subpart A, the aircraft wheels and brakes shall be legibly and permanently marked with the following information:

(1) Name of the manufacturer responsible for compliance.

(2) Serial number and drawing number.

(3) Applicable technical standard order (TSO) number.

(4) Size, (this marking applies to wheels only). All stamped, etched or embossed markings shall be located in non-critical areas.

(c) Data Requirements. (1) the manufacturer shall maintain a current file of complete data regarding all his inspection work and tests required to determine compliance with the standards specified herein. (See paragraph (e) of this section.)

(2) Two copies of the following data shall be furnished to the Chief, Engineering and Manufacturing Division, Bureau of Flight Standards, Federal Aviation Agency, Washington 25, D. C., with the statement of conformance:

(i) Weight of brake assembly.

(ii) Maximum rejected takeoff kinetic energy in foot-pounds.

(iii) Normal kinetic energy in foot-pounds.

(iv) Maximum operating brake pressure.

(v) Applicable speed specified in Note 1 or Note 5 of Table II of AS 227-C.

(vi) Type of hydraulic fluid used.

(vii) Weight of wheel assembly.

(viii) Maximum static load rating in pounds.

(ix) Maximum limit load rating in pounds.

(d) Previously Approved Equipment. Wheels and brakes approved prior to June 1, 1961, may continue to be manufactured under the provisions of their original approval.

(e) Quality control. Each wheel and brake shall be produced under a quality control system, established by the manufacturer, which will assure that each wheel and brake is in conformity with the requirements of this standard and is in an airworthy condition. This system shall be described in the data required under paragraph (c)(1) of this section. A representative of the Administrator shall be permitted to make such inspections and tests at the manufacturer's facility as may be necessary to determine compliance with the requirements of this standard.

(f) Effective date. June 1, 1961.

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc.
485 LEXINGTON AVENUE
NEW YORK 17, N.Y.

AERONAUTICAL STANDARD AS 227 C

WHEELS AND BRAKES
MINIMUM REQUIREMENTS FOR CIVIL AIRCRAFT APPLICATIONS

Issued 8/1/50
Revised 2/1/59

1. PURPOSE: To specify minimum requirements for aircraft wheels and brakes for civil aircraft applications.

2. SCOPE: This specification covers minimum requirements for wheels and brakes in a range of sizes to accommodate the standard sizes and types of tires.

3. GENERAL REQUIREMENTS:

3.1 Materials and Workmanship:

3.1.1 Materials: Materials shall be suitable for the purpose intended. All metals used in the construction of wheels and brakes shall be corrosion resistant unless suitably plated or treated to resist corrosion during stocking and normal service life. The use of dissimilar metals, especially brass, copper, or steel in contact with aluminum, magnesium, or alloys thereof, shall be avoided where practicable.

3.1.2 Workmanship: The workmanship and finish shall be in accordance with high grade aircraft wheel and brake manufacturing practices.

3.2 Identification: Each wheel and each brake assembly shall be plainly marked as follows, and as applicable, in accordance with the ratings selected:

	Wheel	Brake
(a) Size	x	
(b) Serial number and date of manufacture	x	x
(c) Manufacturer's name and drawing number	x	x

Markings shall be of such character that they will not be obliterated or effaced as a result of service usage.

4. DETAIL REQUIREMENTS:

4.1 Design:

4.1.1 Brake Fluid: All hydraulic brakes shall be designed and tested to operate with hydraulic brake fluid or oil specified for the airplane on which the brakes are used.

4.1.2 Lubricant Retainers: Suitable retainers shall be provided to prevent lubricant from reaching the braking surface and to prevent foreign matter from entering the bearings.

4.1.3 Removable Flanges: All removable flanges shall be assembled onto the wheel in a manner that will prevent the removable flange and its retaining device from leaving the wheel if a tire should deflate while the wheel is rolling.

4.1.4 Adjustment: When necessary to insure safe performance, the brake mechanism shall be equipped with suitable adjustment devices.

4.2 Amphibian Applications:

4.2.1 Water Seal: Provision shall be made to seal the wheels of amphibious aircraft to prevent entrance of water into the wheel bearings or other portions of the wheel or brake where the presence of water might be detrimental. Unsealed brake assemblies will be permitted if all exposed materials therein are corrosion resistant, or if the design is such that brake action and service life will not be impaired by the presence of sea water or fresh water.

4.3 Construction:

4.3.1 Radiographic Control: Castings shall be produced under radiographic control when a new foundry source is established, when new size or shape castings are made, or when a change is made in foundry technique. All subsequent inspection of production castings shall require inspection per ARP 586.

4.3.2 Castings: Castings shall be of high quality, clean, sound, and free from blowholes, porosity, or surface defects caused by inclusions, except that loose sand or entrapped gases may be allowed when the serviceability of the casting has not been impaired.

4.3.3 Forgings: Forgings shall be of uniform condition, free from blisters, fins, folds, seams, laps, cracks, segregation, and other defects. If strength and serviceability are not impaired, imperfections may be removed.

4.3.4 Rim Surfaces: The surface of the rim between bead seats shall be free from defects which will be injurious to the inner tube. Holes which extend through a rim shall be drilled out and filled with a flush plug. Other depressions in rim or bead seats which might injure the tube or casing shall be filled with a hard surface permanent filler before applying the primer coat.

4.3.5 Rim Joints: Joints in the rim surface and joints between rim surfaces and demountable flanges shall be smooth, close-fitting, and non-injurious to the inner tube while mounting the tire, or while in service.

4.3.6 Rivets and Bolts: When rivets are used, they shall be well headed over, and rivets or bolts coming in contact with the casing or tube shall be smooth enough not to damage the tube or casing during normal operation.

4.3.7 Bolts and Studs: When bolts and studs are used for fastening together sections of a wheel, the length of the threads for the nut extending into and bearing against the sections shall be held to a minimum; and there shall be sufficient unthreaded bearing area to carry the required load.

4.4 Protective Treatment:

4.4.1 Steel Parts: Wherever possible all steel parts, except braking surfaces and those parts fabricated from corrosion resistant steel, shall be cadmium plated or zinc plated. Where cadmium or zinc plating cannot be applied, the surface shall be thoroughly cleaned and suitably protected from corrosion.

4.4.2 Aluminum Parts: All aluminum alloy parts shall be anodized or have equivalent protection from corrosion.

4.4.3 Magnesium Parts: All magnesium alloy parts shall receive a suitable dichromate treatment or have equivalent protection from corrosion.

4.4.4 Bearing and Braking Surface: The bearings and braking surfaces shall be protected during the application of finish to the wheels and brakes.

4.4.5 Operating Cylinders: Prior to inspection tests, the cylinders shall be suitably cleaned to remove all metal particles and other foreign matter. The cylinder ports shall be suitably capped to prevent entrance of foreign matter.

5. QUALIFICATION TESTS:

5.1 Ratings: Each design of wheel or wheel-brake shall have the following ratings as applicable.

S = Maximum Static Load in lbs.
L = Maximum Limit Load in lbs.
KE = Maximum Kinetic Energy Capacity in ft-lbs at Design Landing Weight.
V_{so} = Minimum Stalling Speed in MPH, (not applicable to Method II analysis per paragraph 5.4.7.1(b).

5.2 Tests Required: Except as qualified by 5.3, the ratings for wheel-brake assemblies shall be substantiated by the following tests as applicable.

(a) Wheel loads, Table I
(b) Brake Capacity, Table II

5.3 Exceptions - as noted:

(a) Tail wheels need not be roll tested.

5.4 Test Methods:

5.4.1 Radial Load Test: This test shall consist of the application of a load equally on both sides of the wheel, to a straight axle passing through the hub, with the tire restrained against a flat non-deflecting surface so that the point of application of the resisting force is centered in the most critical location. In applying this load, the tire may be inflated with water to the specified pressure and the water gradually bled out as the load is increased so that the pressure in the completely deflected tire will equal that of the completely deflected air-inflated tire. A wheel being tested for use with tubeless tire may use conventional tire and tube for test under paragraph (b).

(a) A maximum radial limit load shall be determined by test by loading the wheel assembly to the yield radial load for three separate applications at the same point on the wheel. Successive loadings shall not cause radial permanent set increments of increasing magnitude, and permanent set increment caused by the third loading shall not exceed 5% of the total deflection under that load. Deflections and permanent set readings shall be taken at a suitable point on the wheel to indicate deflections of the wheel rim at the bead seat.

The wheel manufacturer shall select the limit load for which the wheel assembly will be rated.

(b) After determining the maximum radial limit load, the load shall then be increased to at least the ultimate load. The wheel shall support the ultimate load for at least three seconds without failure.

5.4.2 Side Load Test: This test shall consist of the application of a load to the critical side of the wheel in a direction parallel to the axis of the wheel hub, to the side of the tire casing by means of a block which shall cover an arc of not more than 60 degrees and whose centroid shall fall on a point midway between the rim flange O.D. and the nominal tire O.D.

In applying this load, the wheel shall be restrained only by the axle. The tire may be inflated with water to any pressure, not exceeding the burst test pressure, necessary to accomplish the test. A wheel being tested for any use with tubeless tire may use conventional tire and tube for test under paragraph (b).

(a) A side limit load of at least 40% of the maximum radial limit load shall be determined by test by loading the wheel assembly to the yield side load. The requirements for loading and permanent set shall be the same as outlined in paragraph 5.4.1.

(b) After determining the side limit load, the load shall then be increased to at least the ultimate load. The wheel shall support the ultimate load for at least three seconds without failure.

5.4.3 Burst Test: The burst test load shall be applied to the wheel by means of hydrostatic pressure in the tire. The wheel shall be tested to a burst pressure, P, and shall withstand this test without failure.

$$P = pf$$

WHERE:

p = Inflation pressure required for maximum static load (S)

f = Factor specified in Table I

5.4.4 Roll Test: Wheel with tire installed shall withstand, without failure or development of cracks, a roll life specified in Table I under a load not less than the maximum static rating 'S' of the wheel.

5.4.5 Tubeless Wheel Pressure Test:

5.4.5.1 Static Test: The tubeless tire and wheel assembly shall be inflated to a pressure of 1.5 times the rated inflation pressure and, when immersed in water, shall show no signs of leakage as evidenced by bubbles.

5.4.5.2 Diffusion Test: The tubeless tire and wheel assembly shall hold the normal deflection pressure for 24 hours with no greater pressure drop than 5%. This test shall be performed after the tire growth has stabilized.

5.4.6 Alternate Tests: When the tests required by 5.2(a) are not consistent with loads imposed on the airplane, equivalent alternate loads and tests may be evolved to the satisfaction of the airplane manufacturer.

5.4.7 Dynamic Torque Test:

5.4.7.1 Braking Capacity Calculations: Either of the following methods may be used to determine the energy capacity required of the wheel-brake system: (Refer to Table II)

(a) Method I

$K.E. = .0334\ WV^2$

WHERE:

K.E.	= Kinetic energy per wheel-brake system	- ft-lb
W	= Weight, applicable to wheel-brake system	- lbs
V	= Speed, applicable	- mph

(b) Method II

The wheel-brake system kinetic energy may be based on a rational analysis of the sequence of events, which are expected to occur during operational landing at design landing weight or takeoff at maximum weight. The analysis shall include rational or conservative values of airplane speed at which the brakes are applied, braking coefficients of friction between tires and runway, aerodynamic drag, propeller drag, or power plant forward thrust; and, if more critical, the most adverse single engine or propeller malfunction which would result in a loss of drag credit for that engine or propeller.

5.4.7.2 Dynamometer Test: Dynamic torque tests shall be conducted on a suitable inertia brake-testing machine. Conduct wheel-brake tests at the conditions determined by Method I or II calculations and as specified in Table II. Tests may be conducted for the rated energy calculated by Method I and the one stop overload condition on energy calculated by Method II, or the combination may be reversed.

5.4.8 Structural Torque Test: The test shall consist of the application of a torque load tangentially to the wheel at radius (R), the normal rolling radius of the tire under rated static load (S). In applying this load, rotation of the wheel shall be prevented by a force transmitted through the brake, or brakes, but need not consist solely of the brake friction force. Wheel-brake assembly shall withstand either a torque load not less than 1.6 SR/B, where B is the number of identical brakes per wheel, for at least three seconds without failure, or 80% of this value without permanent set. If identical brakes are not used, the torque load shall be proportioned rationally between them.

5.4.9 Static Pressure: The brake, with the actuator piston extended to simulate a maximum worn condition, shall withstand a pressure test as noted in Table II. The maximum operating pressure is the pressure required to hold statically a torque of not less than .55 SR (as defined above) applied to the wheel, or the maximum pressure used in conducting dynamic tests, whichever is the greater. The pressure required for .55 SR shall be determined during these tests.

5.4.10 Endurance: The hydraulic brake shall be subjected to 100,000 cycles of application and release of pressure equal to normal operating pressure, as determined from Dynamic Torque Test, (reference Table II Brake Tests (A) condition) and 5,000 cycles at a pressure equivalent to the maximum operating pressure, as determined from Dynamic Torque Test (reference Table II Brake Test (B) condition). This test shall be conducted using a minimum clearance equivalent to the maximum clearance allowable between adjustments. The first portion of the test may be divided into four parts, such that 25,000 cycles may be applied at each of four positions of brake piston travel conforming to 25 percent, 50 percent, 75 percent, and 100 percent travel, respectively. There shall be no evidence of leakage or other malfunctioning during or upon completion of this test.

5.5 Desirable Features:

5.5.1 Taxi and Parking Test: It may be desirable to subject the brakes to taxi or parking tests. The exact conditions of test should be determined by the brake manufacturer and airframe manufacturer.

5.5.2 Roll Test: For certain types of service it may be desirable to subject the wheel to a roll test of greater than 1000 miles to increase service life. This change is considered desirable for wheels to be used in domestic air carrier type service. In such cases the exact conditions of test should be determined by agreement between the wheel manufacturer and the user.

TABLE I

WHEEL TESTS

TYPE OF AIRCRAFT	RADIAL LOAD (Ref. 5.4.1)		SIDE LOAD (Ref. 5.4.2)		BURST (Ref. 5.4.3)	ROLL (Ref. 5.4.4) (Ref. 5.1)	TUBELESS INFLATION (Ref. 5.4.5)
	YIELD	ULTIMATE	YIELD	ULTIMATE			
Airplane	1.15 x Limit	2.0 x Limit (Castings) 1.5 x Limit (Forgings)	1.15 x Limit	2.0 x Limit (Castings) 1.5 x Limit (Forgings)	3.5 x Inflation Pressure at Rated Load	1000 mile (Note 1) at Load 'S'	1.5 x Inflation Pressure at Rated Load
Rotorcraft	As Above		As Above		3 x Inflation Pressure at Rated Load	250 Mile (Note 1) at Load 'S'	As Above

Note 1 - Wheel being tested for use with tubeless tire may use conventional tires and tubes to demonstrate wheel fatigue life. However, a minimum of 25 miles shall be conducted using a tubeless tire, seals, valves, etc., to demonstrate suitability of the sealing arrangements.

At the conclusion of the 25 miles, the pressure drop shall not exceed 5% of inflation pressure. Test should be conducted on unit with stabilized (maximum tire growth) condition.

TABLE II

BRAKE TESTS

TYPE OF AIRCRAFT	DYNAMIC TORQUE TESTS		STRUCTURAL TORQUE (Ref. 5.4.8)	STATIC PRESSURE (Ref. 5.4.9)
	Method I Calc. (Ref. 5.4.7.1a)	Method II Calc. (Ref. 5.4.7.1b)		
Transport (Part 4b)	(A) 65 stops at Avg. 10 ft/sec^2 See Note 1, 2 and 8 (B) 1 stop at Avg. 6 ft/sec^2 See Note 2, 3 and 8	(A) 65 stops at ** Avg. 10 ft/sec^2 See notes 2, 5 and 8 (B) 1 stop at ** Avg.6 ft/sec^2 See Note 2, 6 and 8	1.6 SR/B* or 1.28 SR/B without Permanent Set	2 x Maximum Operating Pressure for 3 seconds without failure
Non-Transport (Part 3)	(A) 35 stops at Avg.10 ft/sec^2 See Notes 1, 7 and 8	(A) 35 stops at **Avg. 10 ft/sec^2 See Notes 5, 7 and 8	As Above	As Above
Rotorcraft (Part 6) (Part 7)	(A) 20 stops at Avg. 6 ft/sec^2 See Notes 4, 7 and 8		As Above	As Above

Note 1 - Sea level power off stalling speed at design landing weight and configuration.

2 - One change of friction materials is permissible in meeting the 66 stops. For other than friction materials, the assembly shall withstand the 65 stops without failure or impairment of operation.

3 - At most critical combination of take-off weight and anticipated optimum V_1 speed.

4 - At anticipated take-off weight. Rotorcraft speed at brake application shall be determined by analysis.

5 - At airplane speed at brake application as determined by Method II and dynamometer inertia equivalent to give the brake energy as determined by Method II, at design landing weight.

6 - At anticipated optimum (V_1) speed as determined by Method II and dynamometer inertia equivalent to give the anticipated brake energy as determined by Method II, at design take-off weight.

7 - No change of friction materials is permissible in this test. The assembly shall withstand the test without failure and without impairment of operation, for other than friction materials.

8 - Programmed deceleration may be used when airplane speed-torque requirement is determined by analysis. The average deceleration shall not be less than the average noted in Table II above, unless otherwise specified.

* Application for 3 seconds without failure.
** Unless otherwise determined in Method II analysis.

Prepared by Committee A-5, Aircraft Wheels, Brakes, Skid Controls and Axles

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc.
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AERONAUTICAL RECOMMENDED PRACTICE

ARP 586

WHEEL (SAND AND PERMANENT MOLD) CASTINGS MINIMUM REQUIREMENTS FOR CIVIL AIRCRAFT APPLICATIONS

Issued 3-1-60
Revised

1. PURPOSE: To recommend minimum quality control practice and procedure for inspecting magnesium and aluminum wheel (sand and permanent mold) castings for aircraft.

2. SCOPE: This recommended practice covers the minimum quality control required for aircraft wheel castings to assure minimum acceptable quality of internal structure, control of surface imperfections, and control of repair procedures.

3. CASTING RECORDS:

3.1 Castings shall be identified by heat or lot number.

3.2 Affidavits showing conformance to applicable material specifications (SAE, Federal, Air Force, Navy, or Manufacturer) shall be submitted for each lot number. Minimum requirements for the affidavit as determined from standard cast bars from the production lot shall be as follows:

a. Chemical analysis
b. Ultimate strength
c. Yield strength
d. Elongation
e. Statement of compliance with heat treat

4. PROCEDURE FOR ESTABLISHING MINIMUM QUALITY OF CASTING PRODUCTION:

4.1 Thorough radiographic examination of critical areas shall be made of each casting in establishing satisfactory foundry techniques and equipment.

4.2 Thorough fracture examination of each casting by breaking into pieces small enough to detect hidden discontinuities may be made as a substitute for 4.1 in establishing satisfactory foundry techniques and equipment.

4.3 Production techniques in foundry practice, gating, etc., shall not be significantly changed after a suitable casting quality has been established except when authorized by the purchaser after sample castings made with the change of technique have been checked and approved.

4.4 The foundry shall perform only those repairs approved by the purchaser. Repair in critical areas shall be marked and radiographic evidence submitted to show acceptability of the repaired area.

5. PROCEDURE FOR MAINTAINING MINIMUM QUALITY CONTROL OF CASTING PRODUCTION:

5.1 VISUAL INSPECTION: Each casting shall be inspected visually.

5.2 PENETRANT INSPECTION:

5.2.1 Penetrant inspection shall be made only of finished machined castings.

5.2.2 When at least five consecutive acceptable quality castings have been produced, a valid fluorescent penetrant sampling plan as described in paragraph 8. may be applied.

5.3 RADIOGRAPHIC INSPECTION:

5.3.1 Sampling plan may be used instead of the penetrant inspection and may be accomplished before machining. Refer to paragraph 8. for minimum quality control sampling plans.

5.4 Machine scrap or foundry rejects with incidental defects may be used to implement the fracture examination of castings. The examination of these castings may be used to supplement the above inspection techniques.

6. PROCEDURE FOR RE-ESTABLISHING MINIMUM QUALITY CONTROL OF PRODUCTION:

6.1 If routine inspection or fracture examination discloses evidence of undesirable defects, acceptable quality control shall be re-established by new sample approval as outlined in paragraph 4. and inspection resumed as outlined in paragraph 5.

6.2 Fracture examination shall be according to plan designated in paragraphs 8.4 and 8.4.1.

6.3 Radiographic examination shall be according to plan designated in paragraph 8.

7. Re-established quality control of castings shall return to procedures of paragraph 5.

8. SAMPLING PLANS:

8.1 RADIOGRAPHIC CONTROL: (Reference paragraph 5.3)

Lot Size	Sample Size	
		Reduced*
1-2	all	all
3-8	2	2
9-15	3	2
16-25	5	3
26-40	7	3
41-100	10	5

Above 100, 10% of Lot Size

8.2 PENETRANT CONTROL: (Reference paragraph 5.2.2)

8.2.1 100% penetrant until quality control history is established.

8.2.2 Reduced sampling of penetrant inspection.

Lot Size	Sample Size*
1-2	all
3-15	2
16-40	3
41-65	5

Above 65, 10% of Lot Size

*After satisfactory history has been established.

8.3 RADIOGRAPHIC CONTROL: (Reference paragraph 6.3 to re-establish minimum quality control.)

8.3.1 Stringent radiographic controls, similar to paragraph 4.1, shall be resumed anytime the quality level is down and maintained until the manufacturer is satisfied that routine inspection is again satisfactory.

8.4 FRACTURE CONTROL: (Reference paragraph 6.2 to re-establish minimum quality control.)

8.4.1 Fracture production casting until history of fractures indicate minimum quality control is re-established.

9. ALTERNATE INSPECTION PROCEDURES:

9.1 When valid inspection procedures including sampling plans have prior approval of a U.S. government agency (Air Force, Navy, etc.), these procedures may be used in lieu of the procedures outlined.

PREPARED BY SAE COMMITTEE A-5, AIRCRAFT WHEELS, BRAKES, SKID CONTROLS & AXLES